DOCUMENT RESUME

ED 025 092 40 EC 003 371

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Speed Listening Skill by the Blind as a Function of Training. Final Report.
Washington Coll., Chestertown, Md.
Spons Agency- Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No- BR-8-C-024
Pub Date Sep 68
Grant- OEG-3-8-080024-0021(010)
Note- 18p.
EDRS Price MF-$0.25 HC-$1.00
Descriptors- Audiovisual Aids, *Audiovisual Instruction, Auditory Training, Aural Learning, Blind, *Exceptional Child Research, Listening, Listening Comprehension, Listening Skills, Secondary School Students, Skills, Speech Compression, Tape Recordings, *Teaching Methods, *Visually Handicapped

In order to determine whether speed listening practice could improve comprehension of pitch-altered rapid speech, 66 high school students blind since at least age 6 were divided into experimental (E) and control (C) groups, matched on the basis of age (range 15 to 19 years), IQ (range 85 to 130), and pretest comprehension of material presented at normal rates. Using the pitch altering method of speeding up tape recorded material, training was given the E-group at 275 and 300 words per minute (wpm) while the C-group received similar training at the standard 175 wpm level. Subjects were administered two training sessions per day of three trials of taped material (about 875 words each) followed by 10 five-foil multiple choice questions after each trial with a maximum number of 14 sessions. The E-group did significantly better than the C-group on the comprehension posttest administered at 300 wpm (p .001). While a clear cut training effect was obtained, the degree of improvement due to this training (9.47) was not large. (Author)

BR-8C024
PA-40
OCT 17 RECD

FINAL REPORT
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ED025092

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Chestertown, Maryland

September 1968

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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Acknowledgments

The authors are grateful for the assistance given by the staff and children of The Maryland School for the Blind, Florida School for the Deaf and the Blind, New York State School for the Blind and the State of Minnesota Braille and Sight Saving School.

Abstract

In order to evaluate whether the blind can profit from "speed listening" training, 66 blind high school students were divided into matched experimental (E) and control (C) groups. Using the pitch altering method of speeding up tape recorded material, training was given the E group at 275 and 300 words per minute (wpm) while the C group received similar training at the standard 175 wpm level. The E group did signif icantly better in comprehension in the posttest administered at 300 wpm. Although a clear cut training effect was obtained, the degree of improvement in comprehension due to this training was not large.

Introduction

While the blind are not markedly inferior to their sighted peers on appropriate standard intelligence measures (Hayes, 1941; Bauman and Hayes, 1951), they still suffer notably on many school related achievement estimates (Hayes, 1941; Lowenfeld, 1955). Probably the major reason for this relative lack of achievement is that they have a substantially slower rate of assimilating textbook information. For example, after computing a mean on data obtained by Foulke (1964b) it was found that practiced adult Braille readers average only 110 wpm. Many sighted adults read similar materials in print at 400 to 500 wpm levels and above. Using recorded materials, "reading" rates are generally in the 150 to 175 wpm range (McLain, 1962; Korb, 1966). Of course, here the rate is dependent on the speed of speaking of the person who made the recording and this rate is still far below typical reading rates for sighted people. The blind person certainly suffers in academic and vocational competition as a result of lower reading rates. He must either spend a great deal more time in reading or gain less information than his sighted peers. A question of considerable practical importance to the blind arises: can methods be devised whereby the blind can more effectively compete in reading rates with their sighted equals?

Acknowledgments

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Recently, attempts have been made to assess the efficacy of methods designed to increase listening rates. The time compressed speech method, involving the elimination of word segments, has led to only mild improvements in rate before comprehension suffers (Foulke, Amster, Nolan & Bixler, 1962; Foulke, 1966; deHoop, 1967). A second technique, the pitch altering or rapid speech method involves having recorded materials played back at faster rates than those at which they were recorded. This technique results in an increase in pitch and a distortion of timbre of the human voice. From a practical vantage point the rapid speech method seems preferable to the time compressed speech technique since the rapid speech method does not require the use of special personnel, tapes, or apparatus in developing material. This method does require a modification of the tape recorder used in presenting the material, but this modification is technically simple and inexpensive. These issues are germane but of greater import is the fact that the rapid speech method has also been unsuccessful in substantially increasing listening rates since comprehension decreases rapidly as the word per minute rate is increased (Fletcher, 1926; McLain, 1962).

Although little practical value has accrued from research in this area, all published studies known to the authors on the pitch altering method have one severe limitation; they have not attempted to ascertain whether appropriate training would lead to adequate comprehension at increased listening rates. In sighted people speed reading training typically does lead to noteworthy improvement of comprehension at increased reading rates. Can a similar type of training lead to improved listening rates for the blind as well?

Conflicting results have recently been reported regarding whether practice can substantially increase the level of comprehension of time compressed speech (Foulke, 1964a; Orr, Friedman & Williams, 1965; Orr & Friedman, 1968). Unfortunately each of these studies suffers from major methodological problems and it is difficult to evaluate them unambiguously.

Both Foulke (1964a) who found no effects of practice and Orr and Friedman (1968) who found positive results used subjects (Ss) as their own controls. A design of this nature should only be used when it is fairly certain that factors such as accumulation of fatigue, increased test sophistication, rapport with the examiner and familiarity with routines are not important variables. In investigations of practice effects each of these variables could have an influence and neither of the above-mentioned reports indicate any attempts to control for them. In the Orr, Friedman, and Williams study (1965) control Ss were employed but the control Ss did not practice at normal listening speeds nor did they take the short tests after each session that the experimental Ss were administered. The improvement found in the experimental Ss could have been due to increased test sophistication or the effects of some of the other variables mentioned above. In addition, in this latter study, eight different comparisons were made between control and experimental Ss and two significant differences were obtained. The authors did not indicate what statistic they employed and they may have neglected to consider the fact that in making multiple comparisons the probability of obtaining significant results by chance alone is enhanced unless appropriate measures are taken. As a consequence of these problems it can not be determined at present just what effect training has on time compressed speech.

The purpose of this project is to ascertain whether a properly controlled experiment using one specific schedule and type of training of blind students will result in significant increases in comprehension of speeded up tapes (pitch-altered speech).

While it should be recognized that a wide variety of parameters might profitably be studied within the context of this problem, the purpose of this project is merely an attempt to demonstrate that training can be effective in improving listening rates. If such improvement can be demonstrated, it will give impetus to intensive study of these parameters.

Within this context, the specific hypothesis of the study is that, in comparing pre-and post-training comprehension, (measured via objective multiple choice questions), an experimental group of blind students who receive training on increasing speeds of listening will maintain comprehension significantly better than a group of matched controls who receive training but not on speeded up material. The use of matched controls should aid in determining whether the specific training adds something over and above what might accrue from increased test sophistication, rapport with the examiner, familiarity with routines, and similar factors.

Method

Subjects

Sixty-six high school students who had been totally blind since at least the sixth year of life were selected for the study. Cooperation from three schools for the blind was necessary to obtain a pool of Ss this large. Ss from four schools were given training but in one school E group Ss did not meet preset standards and as a consequence data from this school was excluded from the study (see explanation below). The Ss were enrolled in either the academic or general course in their school. Ss were matched in groups on IQ (cut-off range from 85 to 130), age (cut-off range from 15 to 19) and level of comprehension on the pretest materials presented at the standard 175 wpm rate. IQs were obtained from school records and were in all cases based on the Hayes-Binet Intelligence Test or the appropriate verbal sections of the Wechsler Intelligence Scale for Children or the Wechsler Adult Intelligence Scale. All but a few of the Ss had been tested within the past five years. Age data was based on age at the last birthday. To ensure that Ss with noteworthy prior self-training were not included in the study, provision was made to exclude an S if he had used the pitch altering method on his own for 20 hours or more during the past year or 5

hours or more within the month prior to the investigation. No S had to be excluded on this basis. Using data on age, IQ and pretest comprehension scores, the experimenters developed matched E and C groups. By assigning individuals appropriately both within and between schools, an attempt was made to keep the groups nearly equal in terms of both means and standard deviations on all of the above listed variables. Table I summarizes data on this matching. Considering this matching data alone, appropriate t and F tests indicated that none of the differences between C and E groups in means or standard deviations were statistically significant at the 10% level of confidence.

TABLE I

Comparative means and Standard Deviations on Matching Variables (Pretest Scores, Age, IQ) for Experimental and Control Groups.

	E Group		C Group	
	Mean	S.D.	Mean	S.D.
Pretest Score	15.67	4.98	15.70	4.48
Age	16.30	1.03	16.06	1.12
IQ	107.85	12.86	107.82	11.46

Apparatus and Materials -- A Lafayette tape recorder (Model 860) was employed to present the auditory reading material and the comprehension check questions. Special tapes were prepared each having textbook type materials (stories, history and science lessons) of approximately 875 words followed by 10 five-foil multiple choice questions. For the C condition each

of the textbook selections was presented at the standard 175 wpm rate. These were approximately five minutes in length. For the E group identical passages and questions were employed but the wpm rate of the passages was determined by the performance of the Ss. The questions were always presented at the 175 wpm rate.

The passages were read by two male college students who had experience in reading for the blind. To obtain material at 275, 300 and 350 wpm for the E group, tapes were originally recorded at 3 3/4 feet per second and were played back at 7 1/2 feet per second. Using a Variable Frequency Power Supply (VFPS) (Model TS 331, American Foundation for the Blind) in conjunction with the Lafayette tape recorder, the speed of the presentation was brought down to 275 wpm (approximately No. 88 on the VFPS) and 300 wpm (approximately 100 on VFPS). Of course the 350 wpm speed was obtained by merely playing the tapes at 7 1/2 feet per second instead of the 3 3/4 speed at which they were recorded. The VFPS had a somewhat restricted range of use and this apparatus could not be employed to produce tape speeds between 300 and 350 wpm. As a consequence, the 325 wpm level was obtained by attaching a variable voltage D.C. power supply (Model 5050, Lafayette Instrument Co.) to a D.C. operated tape recorder (Model 301, Martel) and recording tapes at a specific slowed down rate. When replayed at the standard 3 3/4 feet per second speed, this resulted in a recording at 325 wpm.

Procedure -- Three trials of taped material presented at the standard 175 wpm rate with appropriate comprehension checks were administered to all Ss in a pretest session. After using Ss scores along with IQ and age data for developing the matched conditions, an E and a C group were formed. In an attempt to standardize motivation of the two groups, they were informed that the purpose of the study was to ascertain which of two training methods was superior for developing good comprehension of speed listening. To the Ss the control group was referred to as Experimental Group I. They were told that they should

attempt to improve their comprehension skills with material given at normal speed in order to determine if they could comprehend well when the material was later speeded up. Ss called Experimental Group 2 (the actual experimental group) were told that they were to attempt to keep comprehension level up when material was presented at increasingly faster speeds. All Ss were given their scores from the previous session when they began a new session. Using standardized instructions the experimenter attempted to motivate the Ss at this time to improve their concentration and their scores on the comprehension checks. This type of technique has been employed in many speed reading courses. The control group was given exactly the same number of three trial sessions, using identical materials and multiple choice questions as the experimental group. The passages listened to by the control group were always presented at the 175 wpm level until the posttesting period. For the experimental group material was speeded up in wpm rate after the pretest. Our pilot work and other related research reports (Foulke et al., 1962) suggested that the critical point at which Ss first experience major difficulty in comprehension is in the vicinity of 275 wpm. All groups in the experimental condition began at this level with a three trial session.

The Es used the performance of Ss in the first school as a guide to their training schedule for Ss in other schools. To maximize the probability of demonstrating a significant training effect within a reasonable time limit, flexibility was embodied in the training schedule employed at the first school. At this school the Es allowed one session each for a pre- and posttest and a maximum of eight sessions for training. The Es were prepared for the possibility of training up to and including a 350 wpm level. However, to insure that the E group was not being pushed beyond their comprehension limit, the wpm rate was not increased until there was less than a 10 percent difference in mean scores between the E and C groups on the comprehension check questions. Furthermore the posttest was administered at the last level at which less than a 10 percent difference in comprehension scores was obtained. At the first school the E group received training at 325 wpm. However,

since they did not reach the point where there was less than a 10 percent difference between their scores and the control group at this level, the posttest was administered at 300 wpm.

In the remaining three schools the investigators attempted to bring the E groups up to this 300 wpm level also. Here again the authors employed the same two above-mentioned standards: less than a 10 percent difference between E and C groups before advancement in wpm rate, and posttesting initiated at the last level at which less than a 10 percent difference had been obtained at the end of training. In these schools the Es allowed for the necessity of additional training to bring the E group up to the wpm level of the E group at the first school by increasing the maximum number of possible training sessions to 14. With this additional training the Es were able to bring only two of the remaining schools up to the 300 wpm level established by the first school. The Ss of the last school did not meet this required criterion and were consequently eliminated from the statistical analysis. It might also be mentioned that at this school most of the C group Ss were attending regular classes in a local high school while none of the E group Ss were enrolled in this program. Due to scheduling and transportation problems, it was not possible to control for this factor in assigning Ss to groups. The investigators felt that many of the C group Ss in this program were more adaptable and capable of acquiring training. This may have led to the difficulty in bringing the E group Ss up to the same comprehension level as the C group Ss when the E group was receiving practice at high wpm rates. During pretest, training and posttest periods no more than two three-trial sessions were administered in any one day and these sessions were always separated by at least a two hour rest period. The sessions typically lasted approximately 45 minutes.

Results

The E group had a mean of 15.67 right (52.2%) on the pretest administered at 175 wpm while the C group obtained a mean of 15.70 right (52.3%) on this same test. On the posttest administered at 300 wpm the E group received a mean of 12.42 right (41.4%) while the C group obtained a mean of 9.61 right (32.0%). Thus there is a 9.4% difference in favor of the experimental group on the posttest. Considering the decrement in scores from the pretest given at normal speed to the posttest given at 300 wpm, the E group's performance diminished by 10.8% while the C group showed a 20.3% decrease (see Table II). In relative terms, using pretest scores as a base rate, the E group comprehended 79.3% of base rate while the C group comprehended 61.2% of base rate. If this measure is employed, the experimental group shows an 18.1% improvement over the control group after practice.

TABLE II

A Comparison of Experimental and Control Groups on Pretest and Posttest Measures of Comprehension.

	Pretest 175 wpm		Posttest 300 wpm		Amount of Decrement	
	Mean	%Correct	Mean	%Correct	Mean	%Correct
E Gr.	15.67	52.2	12.42	41.4	3.25	10.8
C Gr.	15.70	52.3	9.61	32.0	6.09	20.3

A 2 x 2 factorial analysis of variance was employed to analyze the results of this study. The training in speed listening factor yielded an F (1,64) of 2.17, $P > .05$. The pretest versus posttest factor

resulted in an F (1,64) = 80.35, P< .001. The interaction was also found to be significant with F (1,64)= 7.48, P< .01. A Newman-Keuls test was performed to aid in evaluating the significance of this interaction. As predicted the significant difference in means was found to be between E and C groups on the posttest, F (1,128) - 6.80, P< .01. There was no significant difference between the groups on the pretest with F (1,128) = 0.001, P> .10.

Discussion

The results of the analysis of variance and the Newman-Keuls test supported our initial hypothesis that training does significantly influence the ability of blind students to comprehend textbook like material that is speeded up via the pitch altering method. However the 9.4% difference on the posttest in favor of the experimental group, while statistically significant, is not very large.

As anticipated there was a significant decrement in comprehension from the pretest administered at 175 wpm to the posttest given at 300 wpm. Both the experimental group and the control group displayed this decrement. Of course the significant interaction indicates that the experimental group showed significantly less decrement than the control. Looking at the data from this vantage point, the control group displayed a 20.3% decrement in performance on the posttest while the 10.8% decrement of the experimental group on this test indicates that training resulted in reducing this decrement by approximately one half.

For rough comparison purposes with other studies, the present authors found an 18.1% posttest difference favoring the E group when comprehension was evaluated via comparison with a base rate. However, reporting results in this manner may make improvements in comprehension seem overly large, especially to readers unfamiliar with this approach.

While three previous published reports (Foulke, 1964a; Orr, Friedman & Williams, 1965; Orr & Friedman, 1968) have investigated the effects of practice on comprehension of time compressed speech, both the conflicting results and methodological problems noted above lead to difficulties in interpreting their conclusions. The present study employed what the authors consider a superior design and investigated speech that was speeded up via the pitch altering method. Clear cut training effects were obtained although the degree of improvement in comprehension due to this training was not large. In part this was perhaps due to the fact that limited time prevented the investigators from training at listening rates in excess of 325 wpm. The control group showed a decrement in comprehension of only 20.3% on the posttest. At higher speeds this decrement might have been larger and training therefore might have resulted in more noteworthy improvement over this decrement. An investigation involving a more extensive training schedule might answer the question of whether additional training at higher wpm levels leads to more significant improvement over a control group's performance.

However, the purpose of this study was merely to determine if a training effect could be obtained. If these results are reliable, as the authors believe they are, parameters such as training methods, subject characteristics, schedules of intra and inter distributions of practice might now be profitably studied to determine optimal conditions for producing significant increases in comprehension. In view of these results and the above noted practical advantages of the pitch altering method for speeding up taped material, it appears that this technique has not been given sufficient research attention.

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